





Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

IEC SC17A: Harmonization of IEC & ANSI/IEEE Standards for High-voltage Circuit-breakers

IEC Symposium, Sapporo, July 2004

Denis Dufournet

Chairman TC17 & SC17A

Senior Member IEEE



Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Proposals to harmonize IEC & ANSI standards for high-voltage circuit-breakers can be traced back to the 1980's
 - ▶ C.L.Wagner and H.M. Smith “Analysis of TRV rating concepts”, IEEE Transactions on PAS, Nov. 1984,
 - ▶ S. S.Berneryd “Improvements possible in testing standards for HV circuit-breakers, Harmonization of ANSI and IEC testing”, IEEE Transactions on Power Delivery, Oct. 1988.
- ▶ First “harmonized” document in 1993/1994: IEEE C37.015/IEC 61233 “Shunt reactor Switching”
Project leaders: D.Peelo & S.S.Berneryd
- ▶ Other early contributions by R.Harner, E.Ruoss, A.Bosma & H.H.Schramm.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ **Aim: Common Switching & Breaking Tests in IEC & ANSI/IEEE Standards**
- ▶ Since 1995, three main actions undertaken:
 - ▶ Harmonization of TRVs for breaking tests of circuit-breakers rated 100 kV and higher,
 - ▶ Harmonization of ratings and test requirements for capacitive current switching,
 - ▶ Harmonization of TRVs for breaking tests of circuit-breakers rated less than 100 kV.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Definition of TRV:
 - ▶ recovery voltage that appears across the terminals of a pole of circuit-breaker, during the initial interval of time after the breaking of current.
- ▶ For historical reasons, TRVs for high-voltage circuit-breakers have been represented by different wave-shapes by IEC and ANSI/IEEE for 40 years.
- ▶ Thanks to efforts by IEC & IEEE, this situation is about to change and TRVs for high-voltage circuit-breakers will be described in the same way.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

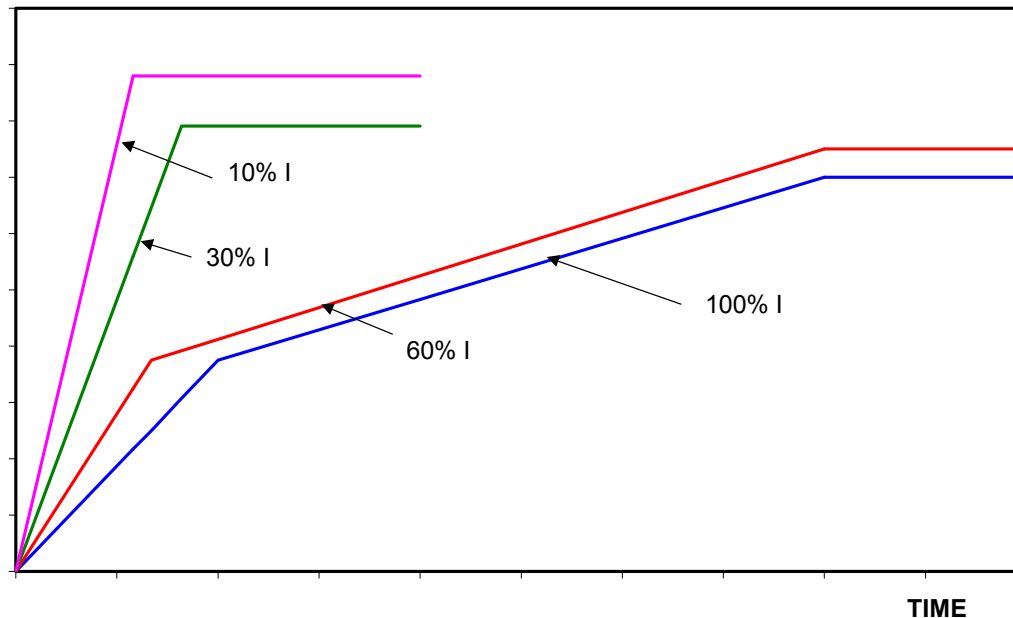
- ▶ Common Breaking Tests for Circuit-breakers rated 100 kV and above
 - ▶ Project conducted by IEC SC17A WG23 with participation by the IEEE Switchgear Committee.
 - ▶ WG23 made a proposal for common Transient Recovery Voltages (TRV) with
 - Same description by 2 or 4 parameters, as defined in IEC standards,
 - Common values of TRV parameters.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Breaking Tests for Circuit-breakers rated 100 kV and above

TRV description for circuit-breakers rated 100 kV and above, as function of rated breaking current

VOLTAGE



Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

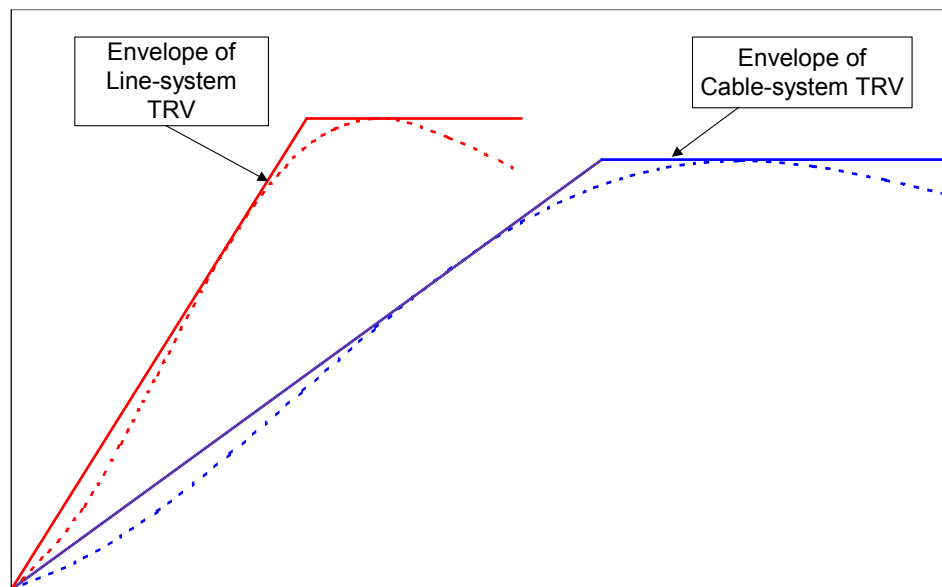
- ▶ Common Breaking Tests for Circuit-breakers rated 100 kV and above
 - ▶ Present situation
 - Project adopted by IEC SC17A: amendment 1 to IEC 62271-100, published in 2003-04.
 - Project in progress in IEEE, drafts of relevant standards are ready and will be balloted in 2004.
 - When revisions of IEC 62271-100 and ANSI/IEEE C37.04b /06 /09 /011 are completed, TRVs will be common, with few differences.
 - Breaking tests procedures were already largely harmonized in IEC 62271-100 (2001) and ANSI/IEEE C37.09 (1999).

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Breaking Tests for Circuit-breakers rated less than 100 kV
 - ▶ Running Project by IEC SC17A: Revision of TRVs
 - Project started in 2001, 2nd CD published in 2004,
 - Aim: Revision of TRVs, to cover the different types of systems with maximum voltage higher than 1 kV and less than 100 kV,
 - Harmonization with IEEE,
 - Consider the work of CIGRE (CIGRE Task Force Report in Electra N°88-1983, CIGRE-CIRED WGCC03 Report 134, 12-1998).

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Breaking Tests for Circuit-breakers rated less than 100 kV
 - ▶ IEC plans to introduce 2 classes of circuit-breakers for cable-systems and line-systems, defined by 2 TRV characteristics:

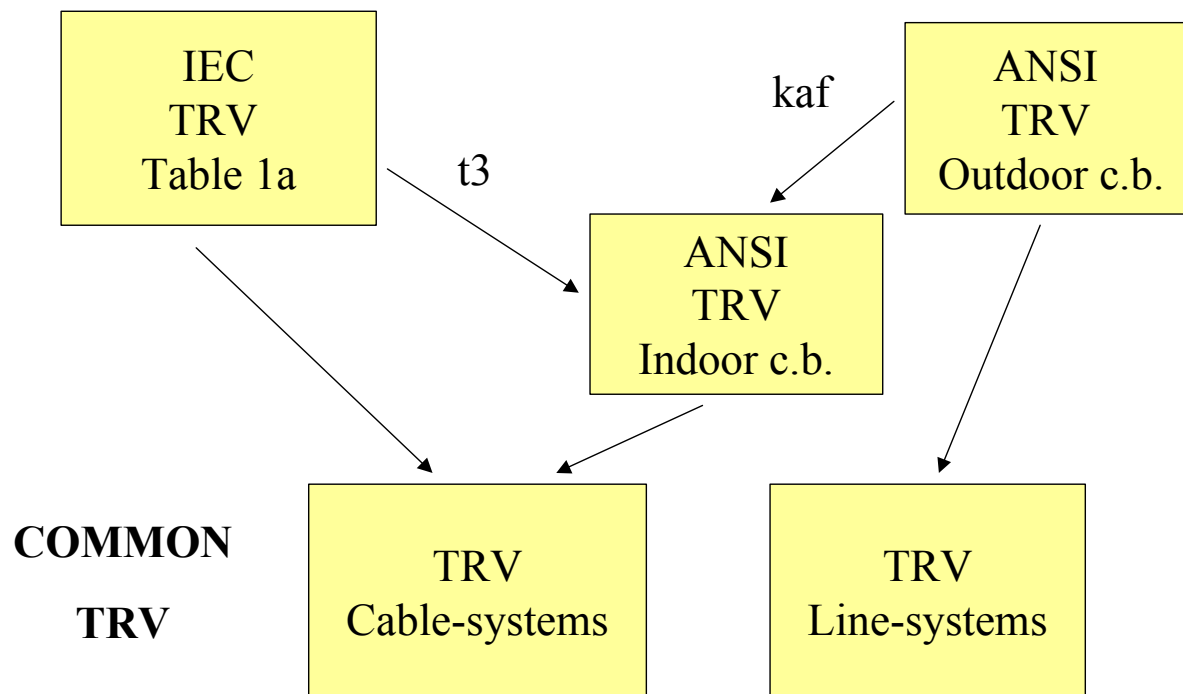


Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Breaking Tests for Circuit-breakers rated less than 100 kV
 - ▶ IEC will keep its present values for circuit-breakers in cable-systems,
 - ▶ IEC plans to adopt ANSI/IEEE TRV parameters for circuit-breakers in line-systems,
 - ▶ Revision in IEC will lead to amend. 2 f1 to 62271-100.
 - ▶ In May 2004, IEEE Working Groups in charge of TRV revision have decided to adopt present IEC values for its indoor (cable) circuit-breakers in C37.06 and 04.
 - ▶ According to this plan, IEC and ANSI/IEEE would have common TRV values for circuit-breakers rated less than 100kV.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Breaking Tests for Circuit-breakers rated less than 100 kV



Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Capacitive Current Tests for High-voltage Circuit-breakers
 - ▶ Common IEC - IEEE Task Force established in 1995,
 - ▶ Aim: to have common / revised ratings & test procedures
 - ▶ Main features of the revision:
 - Introduction of class C1 of circuit-breakers with a low probability of restrike. They are tested as in former IEC 60056 and ANSI/IEEE C37.09.
 - Introduction of a new class C2 of circuit-breakers with a very low probability of restrike. Testing is defined in a new program with more tests (x 2) and pre-conditioning of contacts.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

- ▶ Common Capacitive Current Tests for High-voltage Circuit-breakers
 - ▶ Present situation in IEC
 - Revision implemented in IEC 62271-100 (2001),
 - Improvements planned in Amendment 2 f2 of 62271-100,
 - Subject covered in the future IEC-CIGRE Application Guide to IEC 62271-100.
 - ▶ Present situation in IEEE
 - Revised ratings adopted in C37.04a (2003),
 - Testing procedures in C37.09 almost adopted, new ballot planned before end of 2004,
 - Application Guide C37.012 has been revised accordingly and harmonized with IEC, ballot in progress.

Harmonization IEC - ANSI/IEEE Standards for HV Circuit-breakers

▶ Conclusion

- ▶ A considerable amount of work has been done by common IEC -IEEE Working groups to harmonize:
 - Breaking tests for High-voltage circuit-breakers rated 100kV and higher,
 - Capacitive current switching tests for high-voltage circuit-breakers
- ▶ Work in progress in IEC & IEEE to have common breaking tests for circuit-breakers rated less than 100kV.
- ▶ When this is completed, our common objective ONE TEST FOR ALL, will be achieved for breaking and switching tests.



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

**Thanks for your attention.
Questions ?**

